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ABSTRACT

Kanawha County (West Virginia) schools use Z-scores to identify elementary students eligible for Chapter 1 services in reading and mathematics. A probit analysis of over 500 previously served students was used to determine the variables and weights in the Z-score equations. Independent variables were chosen from those commonly used to identify Chapter 1 students. The best predictor formula for reading services used student's age, Comprehensive Test of Basic Skills (CTBS) total reading (or MRT reading composite) normal curve equivalent (NCE) score, end-of-year letter grade in reading, and number of times a student had been retained. For mathematics, best prediction was obtained with CTBS total mathematics (or MRT) NCE scores, end-of-year grade in mathematics, and grade level of the student. Additional formulas were developed to account for missing scores and grades. Using these formulas, initial eligibility lists are developed in the summer and given to Chapter 1 project teachers, who modify and update them throughout the year. Problems and advantages of the method are noted, and some examples of use of Z-scores for other purposes are given. Three tables present Z-score information. Attachments include eligibility lists, forms to amend the lists, and a report using Z-scores in an evaluation of the Reading Recovery Program in the county. (Author/SLD)

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Chapter 1 Eligibility Factors and Weights:

Using Probit Analysis to Determine Eligibility Criteria

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Paper presented at the annual meeting of the
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Atlanta, Georgia
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Abstract

Kanawha County (WV) Schools uses Z-scores to identify elementary students eligible for Chapter 1 services in reading and mathematics. A probit analysis of over 500 previously served students was used to determine the variables and weights in the Z-score equations. The independent variables were chosen from those commonly used to identify Chapter 1 students and which were collected and available to Chapter 1 staff. The "best predictor" formula chosen for reading services used student's age, CTBS total reading (or MRT reading composite) NCE score, end-of-the-year letter grade in reading, and number of times a student had been retained. For math the "best predictor" formula had CTBS total math (or MRT quantitative) NCE score, end-of-the-year letter grade in math and the grade level of the student. Additional formulas were developed to account for missing test scores and letter grades. Using these formulas (four for reading and four for math) initial eligibility lists are developed during the summer and given to Chapter 1 project teachers at the beginning of school. Teachers modify this list during the first three to four weeks, adding students new to the school and eliminating those that have moved. Throughout the year Chapter 1 teachers, through collaboration with classroom teachers, update the list, modifying Z-scores of students needing or not needing the services. The formulas and procedures for collecting data and for updating lists are presented. Problems and advantages of the method are noted. The Z-scores-- as indices of "educational advantage"-- may be used for purposes other than Chapter 1 selection. Some examples are given.

Kanawha County Schools (KCS) is a public system of approximately 35,000, K through 12, students and 100 buildings. The Chapter 1 program has approximately 1700 students in grades 1 through 6 in reading and math projects at 25 elementary schools. It employs over 50 teachers and aides. In November 1990 Chapter 1 staff sought alternatives to spring or fall testing of elementary students to determine eligibility for Chapter 1 services. The validity or quality of the selection provided by the tests was not the issue. The testing took too much time and effort and delayed the start of Chapter 1 instruction by as much as three to six weeks at the beginning of school. Also teachers and administrators thought that elementary students were being tested excessively by external agencies. The Kanawha County Schools Chapter 1 staff decided to see if there were factors which could be used to predict which students were eligible for Chapter 1 service. These factors should be from data routinely collected by the county data processing unit and by the Chapter 1 program, such as a school-based student data base, computer tapes of test scores, and Chapter 1 evaluation data on pc spreadsheets. The staff conducted a probit analysis of previously served Chapter 1 students. The results were formulas for converting student information (letter grades, test scores, age, retentions, etc.) into Z-scores. Students were selected using these Z-scores for the 1991-92 and 1992-93 school years with seemingly valid results and teacher satisfaction.

Objectives

There were several objectives for revising the Chapter 1 selection process. One was to reduce the amount of student testing. Elementary students are tested in reading and math three times in Spring on three different instruments and four times a year on county-developed critical skills tests in reading and math. Besides the elementary curriculum had shifted to whole language which made the commercial test objectives and diagnostic reports the commercial test used for selection out of synch with new reading and math instruction. A second objective was to allow Chapter 1 teachers to begin instruction earlier. Using the tests and developing eligibility lists which ranked students by "educational need" took approximately three to four weeks to complete at some schools. A third objective was to minimize paper work by teachers. The testing entailed conscientious teachers getting lists of potential students from classroom teachers, giving the tests under standardized conditions, sending the booklets and answer sheets to the central office for scoring and receiving score reports from which they made eligibility lists. A fourth objective was discovered *post hoc*. It turned out that using Z-scores streamlined the procedures of teachers for entering and exiting students from their programs.

Perspective

A meeting was convened to explore alternatives. The meeting consisted of central office Chapter 1 and curriculum staff, state Chapter 1 personnel and a consultant from the Federally-funded technical assistance center (TAC). Selection methods of other programs within West Virginia and other states were reviewed. Many methods combined teacher judgments with other information on pupils such as test scores, letter grades, promotion, attendance, etc. These factors would be assigned weights and added together for a score. A cut-off would be set and children falling below (or above) would be eligible for service. The county Chapter 1 staff was urged to do something similar. Rather than arbitrarily choose the factors to include in such a score and the weight to give them, the Chapter 1 staff suggested an empirical study. A study was conducted to identify the factors and the

weights based on children who had been selected by the testing method. Teachers agreed that the children selected seemed to be the right ones, the issue was how to do this more efficiently.

Method

A probit analysis was chosen to identify factors and weights. It gives a regression-like solution for the dichotomous dependent variable of being in or out of Chapter 1. The Chapter 1 staff used a probit add-on program to its computer stat package (Steinberg, 1988).

Students in six schools during the 1989-90 school year were the subjects. Students were coded as "1" for Chapter 1 served and "0" for not served. Two schools were chosen because they typified the extremes of the county: an inner city school and a small rural school. The other four schools were chosen by Chapter 1 reading and math specialists as having done an exemplary job of selecting students. The idea was to determine what variables available in the Spring of 1989 would predict Chapter 1 selection in the Fall of 1989. Spring 1989 was the earliest that norm-referenced test (NRT) scores were available. There was a teacher strike during standardized testing in the Spring of 1990. The turmoil of strike made the scores suspect. The state which controls third and sixth grade testing said their "grouped" scores were invalid.

Data Source

School enrollments were reconstructed from permanent record information. Chapter 1 participation lists for 1989-90 were used to identify Chapter 1 students.

Permanent record cards, the student data base and Chapter 1 evaluation files were reviewed to see what factors were collected by the system and also used in selection processes for other Chapter 1 programs. This information was: Age, i.e., birth date (month, day, year); grade level (as of June 1989 for the 1988-89 school year); final letter grade in reading; final letter grade in math; final instructional level in reading (PP1, PP2, PP3, P, 1, 2/1, 2/2, 3/1 etc); final instructional level in math; days absence; promoted (yes or no); number of times retained; number of times transferred; NCE score in total reading (for March, 1989); NCE score in total math (for March, 1989). This information was collected on the reconstructed enrollments. There were three limitations to the sampling frame. There were no instructional levels or test scores for kindergarten; fifth graders were now seventh graders and their cards placed in junior high schools; and in 1989-90 the Chapter 1 math only worked with third, through sixth grades. The resulting data set used in the study had 535 students.

Additional variables were constructed. One was a transformations of the retention variable. Retention is rare. A child can only be retained twice according to county policy, and some schools have a policy of no retentions. A square root transformation was used (Snedecor & Cochran, 1967, pp 325-327). Two indices were developed for the discrepancy between grade and instructional levels. After quantifying instructional level, one index was simply subtracting the instructional level from the grade level; the other was a ratio of instructional level divided by grade level.

Results and conclusions

Model statements for reading and math specified a constant and independent variables with no interactions. The criteria for acceptable solutions were the highest "pseudo R-square" with fewest variables. A pseudo-R-square used the Chi-square fit statistic provided by the

program as suggested by Aldrich and Nelson (1984). All variables had to have significant t-statistics.

The results were formulas which gave Z-score probabilities. The higher the Z-score the more likely the student was in Chapter 1. There were different formulas for reading and for math. The best reading solution had four factors plus a constant: the student's age (in months), the number of retentions, the reading letter grade, and the CTBS total reading score in NCE's. The formula was:

1	Constant	5.620349
2	Age	-0.02824641
3	Test Score	-0.04340120
4	Letter Grade	-0.43142430
5	Retentions	0.7372828

The weights on the right are multipliers. To calculate the Z-score, one begins with the constant, 5.620349, adds the age (in months) times -0.02824641, adds the NCE score times -0.04340120, adds the quantified letter grade (i.e., A=4, B=3, C=2, D=1, F, E=0, S=2.5, N=0) times -0.4314243, and adds the number of retentions times 0.7372828. The negative multipliers indicate an inverse relationship. The higher the age (the older the student), test score, and letter grade, the less likely the student was in Chapter 1 reading. On the other hand if a child had been retained, the more likely he or she was in Chapter 1 reading. The constant simply moves the location of "0" (zero). The higher the constant, the more positive numbers; the lower the constant, the less positive numbers.

The next best equation had the same variables but used the square-root transformation for retention.

The "best predictor" formula for math also had four variables plus a constant. The test score and letter grade were included as with reading; but instead of retention and age, the math formula had both grade level and instructional level. However designation of instructional level was not systematic and it was decided to go with the next best which did not include the instructional level. This formula for math had one less variable:

1	Constant	7.066732
2	Test Score	-0.1232681
3	Letter Grade	-0.9970630
4	Grade Level	0.1490670

The reading solution had a Chi-square fit ratio of 179.579 and an N of 402 which gave a pseudo-R-square of 0.309. (The Chi-square divided by N plus the Chi-square, p. 57, Aldrich & Nelson). The math had a Chi-square of 118.83, an N of 397 and a pseudo-R-Square of 0.23. Tables of actual and predicted selection were made to see how well the above solutions worked. Table 1, "Predicted & Actual Scores: Total Sample & By School," gives a summary of these. The formulas seemed to work better in some schools than in others. The sample had been more limited than expected. The low R-square indices and percent of selection "hits" were evidence that other factors had a role in identifying students served in Chapter 1 but may be adequate in identifying students eligible for Chapter 1. The overall "hits" were deemed acceptable by Chapter 1 curricular staff. The staff also liked the way the formulas "focused" their programs. For reading the formulas gave a concentration on the younger child, while for math it was the child in the upper grade levels. (Tables 2

and 3, "1992 Fall Eligibility Statistics: Reading" and "1992 Fall Eligibility Statistics: Math," give the distributions of eligible students by grade levels in Fall, 1992.) It was decided to go with these formulas to determine eligible students for the coming year. Besides the more current data would provide a further check of the formulas.

During the summer of 1991, selection index numbers, i.e., Z-scores, were run on all in-coming Fall students, kindergarten through grade 5. Chapter 1 requested principals at the end of the 1990-91 school year to enter letter grades and instructional levels on a module of the student data base operated by KCS data processing. School personal were not accustomed to using this module, which was designed more for secondary school use. Consequently there were missing data. Six schools had bad or empty disks, 18 had missing letter grades for reading and/or math at some grade levels. Also birth dates were inaccurate. Chapter 1 clerks used permanent record card files to replace and correct missing and inaccurate data. Permanent record cards were used also to create a file of student retentions. Test scores were assembled from four sources. Grades 1 and 2 came from a CTBS scoring tape purchased by Chapter 1; grades 3 and 6 came from a tape provided by the state education department; grades 4 and 5 came from a tape provided by the county; and kindergarten scores had to be transcribed from copies of scoring forms completed by teachers for the Metropolitan Readiness Test (MRT) in May. Additional equations were developed to deal with missing letter grades and test scores. These are given in Table 4, "Probit Formulas for Reading and Math Chapter 1 Eligibility." Teachers from several schools reviewed their students selected in early August. They felt the students selected were ranked properly but some were excluded. To get the number requested by the teachers the constants for reading and math were increased. The reading constant was increased by .40 and became 6.020349 and 1.0 was added to the math constant and it became 8.066732.

Lists of eligible students for reading and math in all Chapter 1 schools were then prepared and given to teachers during preschool inservice in late August. The lists were labelled "Initial" to give teachers time to revise the index numbers. Some students may have been selected who did not need the service and some not selected who did. Chapter 1 and classroom teachers were encouraged to cooperatively make the appropriate judgements about their students. They could also add students new to the school and delete those students who had moved over the summer. An official "fall" list was distributed in October. Updates of the list were made whenever teachers need new lists. This procedure was followed again this 1992-93 school year. Lists are generated with a MS-DOS spreadsheet program. (A sample of these lists and forms are attached to this report.)

A further development took place this Winter when Chapter 1 teachers were given a spreadsheet program for their Apple II e's. The program can exchange data with the MS-DOS spreadsheet. Teachers now have the formulas to generate their own participation lists. They can also keep data for Chapter 1 required "desired outcomes." In addition a Windows-based database program is being developed to automate the generation of eligibility lists and evaluation reports.

Issues and Concerns

There have been problems with the results. A State Chapter 1 on-site last March found too many on "waiting list." The constants for this year (1992-93) were changed back to the original numbers to decrease the number eligible. Last year (1991-92) a greater number of children in the early grades were picked for math than anticipated. (See Table 3, "1992 Fall

Eligibility Statistics: Math.") This may reflect the use of the MRT quantitative score in the math Z-score formula. The MRT is given to kindergarten pupils in May. The sample we used to derived the formulas did not have any students in math below grade 3. Grade 1 and 2 were just added to the math program last year. This year a "handicap" was given to the first graders who were kindergartners last year. Seventeen (17) percentile points were added to their quantitative scores. This increased the NCEs and reduced the number of first graders eligible for Chapter 1 math services.

The adequacy of the formulas may be a concern to others wanting to conduct such a study. Certainly there are additional independent variables which are factors of "educational disadvantage." And the model may be other than additive.

Another issue raised by using these formulas is the variability of letter grades. Some teachers are "strict" graders, some are "loose." Achievement is not the sole criterion for letter grades, either. Students' grades may reflect compliancy, "effort," etc. Also some teachers assign grades on instructional levels of their students. Instructional levels may be below that of the students' grade levels. Thus letter grades are not the same from school to school. Students who achieve below grade level and may qualify for Chapter 1 services may have high letter grades.

Another issue is the use of test scores. The tests may not reflect the curriculum. Also there is the phenomenon of achievement detriment related to summer vacation. Some students who show achievement gains by the end of the school year seem to lose momentum and begin the succeeding school year in the Fall at levels below their Spring achievement. Again, giving teachers freedom to adjust their lists has helped alleviate these two concerns.

Educational Importance

This selection process avoids additional testing. It uses scores from mandatory NRT programs or achievement score estimates of teachers (Shinn, Tindal & Spira, 1987). The selection index (Z-score) is a multiple indicator. Factors other than test scores are considered. The index has an empirical origin. Principals use the list of students in a school ranked by reading indices to identify "at-risk" students. Evaluators can use the Z-scores to separate students into levels of educationally advantaged, or achievement levels as in Hiebert, Colt, Catto & Gury (1992), to gauge intervention effects. A study of Reading Recovery using Z-scores for this purpose is attached.

This selection process is easily replicated. Other Chapter 1 programs can use probit, or logit, analysis to determine their own unique solutions.

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Table 1
PREDICTED & ACTUAL SCORES: Total Sample & By School

Total Reading Sample

		PREDICTED 1	0		%HITS IN	%HITS OUT
ACTUAL	1	71	53	124	57.3%	
	0	27	251	278		90.3%
		98	304	402		

School Reading Samples

SCH	TOT	ACTUAL	PREDIC	IN MISS	OUT MISS	TOT MISS	%HITS IN	%HITS OUT
Brid	53	18	12	10	4	14	44.4%	88.6%
Chan	53	28	22	9	3	12	67.9%	88.0%
Ford	80	16	15	8	7	15	50.0%	89.1%
Glen	77	15	17	5	7	12	66.7%	88.7%
Taft	85	28	16	15	3	18	46.4%	94.7%
Tisk	54	19	16	6	3	9	68.4%	91.4%
	402	124	98	53	27	80	57.3%	90.3%

Total Math Sample

		PREDICTED 1	0		%HITS IN	%HITS OUT
ACTUAL	1	58	58	116	50.0%	
	0	27	254	281		90.4%
		85	312	397		

School Math Samples

	TOT	ACTUAL	PREDIC	IN MISS	OUT MISS	TOT MISS	%HITS IN	%HITS OUT
Brid	53	15	7	9	1	10	40.0%	97.4%
Chan	53	18	18	6	6	12	66.7%	82.9%
Ford	78	18	11	15	8	23	16.7%	86.7%
Glen	76	20	12	12	4	16	40.0%	92.9%
Taft	84	26	21	9	4	13	65.4%	93.1%
Tisk	53	19	16	7	4	11	63.2%	88.2%
	397	116	85	58	27	85	50.0%	90.4%

%HITS IN is the union of the actual and the predicted number served divided by the actual number served.
%HITS OUT is the union of the actual and predicted numbers not served divided by the actual number not served.

Table 2
1992 FALL ELIGIBILITY STATISTICS: READING

													========>TOP 40<========					
SCH	N	R	TOP RANGE	LOW RANGE	MEAN	% R	1st	2nd	3rd	4th	5th	6th	1ST	2ND	3RD	4TH	5TH	6TH
ALUM	197	66	3.217227	-3.306897	0.197970	33.5%	24	15	11	10	2	4	19	5	5	8	2	1
ANNE	278	82	3.605846	-3.083457	0.197842	29.5%	33	15	16	11	6	1	24	3	7	3	3	0
BONH	289	57	2.790512	-3.249125	0.145329	19.7%	23	10	9	8	6	1	18	6	7	3	6	0
BRID	116	37	2.751660	-3.822163	0.284483	31.9%	11	6	5	7	4	4	12	7	5	7	5	4
BUEN	143	37	3.703392	-2.973492	0.055944	25.9%	21	10	1	3	1	1	21	11	3	3	1	1
CEDA	376	149	3.506989	-3.730593	0.265957	39.6%	51	36	28	18	8	8	20	6	10	4	0	0
CHAN	141	77	3.394003	-2.004006	0.319149	54.6%	36	16	9	7	6	3	25	7	5	1	1	1
CHES	213	70	3.494140	-3.391636	0.276995	32.9%	20	4	16	13	11	6	17	2	7	5	3	6
EDIS	86	24	3.009795	-2.967043	0.220930	27.9%	6	8	2	5	1	2	14	9	5	7	1	4
FORD	180	57	3.946082	-2.716253	0.172222	31.7%	20	9	8	7	10	3	15	8	4	5	6	2
FRAM	145	43	3.064011	-3.335143	0.248276	29.7%	12	7	4	8	7	5	11	7	4	8	7	3
GLEN	259	108	3.330213	-2.675485	0.277992	41.7%	38	20	15	14	14	7	22	7	5	2	4	0
MALD	186	55	3.289983	-3.702347	0.026882	29.6%	21	21	6	7	0	0	15	14	6	5	0	0
MARM	192	80	2.790655	-2.857485	0.234375	41.7%	24	12	19	9	8	8	16	5	11	4	2	2
MIDL	146	43	2.879806	-3.476375	0.123288	29.5%	20	15	5	2	0	1	20	13	4	2	0	1
OAKW	128	37	4.172054	-3.383908	0.054688	28.9%	19	8	4	5	1	0	19	9	6	5	1	0
PIED	365	130	3.833097	-3.532868	0.046575	35.6%	59	40	14	8	4	5	19	18	2	1	0	0
PRAT	290	91	3.469848	-3.083457	0.244828	31.4%	40	12	11	11	11	6	26	4	4	3	1	2
RAND	95	24	1.971509	-2.606288	0.021053	25.3%	7	6	4	5	2	0	10	10	5	9	6	0
SHAR	245	78	3.333313	-2.897259	0.236735	31.8%	36	13	13	7	6	3	23	7	5	4	1	0
SPRI	206	62	2.898335	-3.196442	0.189320	30.1%	27	10	13	6	4	2	20	4	10	2	4	0
TAFT	173	52	3.547757	-3.110312	0.144509	30.1%	15	12	10	8	7	0	13	8	10	6	3	0
TISK	121	26	2.395063	-2.610099	0.033058	21.5%	4	7	8	5	2	0	5	13	11	7	2	2
WALL	166	68	3.506989	-2.945245	0.198795	41.0%	28	11	11	7	9	2	23	2	5	3	7	0
WATT	123	55	2.847005	-3.391636	0.186992	44.7%	24	11	9	4	3	4	20	6	5	4	2	3
WEIM	187	66	3.245331	-3.058231	0.272727	35.3%	18	18	15	4	4	7	15	9	6	3	4	3
TOTs	5046	1674	4.172054	-3.822163	0.185692	33.2%	637	352	266	199	137	83	462	200	157	114	72	35

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2

Table 3
1992 FALL ELIGIBILITY STATISTICS: MATH

SCH	N	M	TOP RANGE	LOW RANGE	MEAN	% M	1st	2nd	3rd	4th	5th	6th	=>TOP 40<= 1ST	2ND	3RD	4TH	5TH	6TH
ALUM	199	65	6.125968	-7.677861	-1.463516	32.7%	11	10	10	17	9	8	7	4	6	15	3	5
ANNE	278	75	6.600987	-7.677861	-1.849810	27.0%	20	7	11	13	15	9	13	4	7	5	9	2
BONH	282	79	7.840803	-7.677861	-1.828246	28.0%	20	8	7	11	17	16	10	2	3	4	14	7
BRID	122	30	5.484974	-7.379727	-1.332905	24.6%	7	3	2	7	8	3	8	4	3	10	11	4
BUEN	149	40	5.381778	-7.528794	-1.562037	26.8%	13	5	2	5	10	5	13	5	2	5	10	5
CEDA	382	159	6.899121	-7.677861	-0.666265	41.6%	42	27	23	27	16	24	15	6	7	6	1	5
CHAN	145	71	5.886032	-7.379727	-0.112424	49.0%	27	10	8	9	12	5	18	7	4	5	4	2
CHES	213	90	8.390665	-7.677861	-0.550469	42.3%	15	7	15	19	13	21	7	4	8	10	5	6
EDIS	81	28	5.530845	-6.975233	-0.802945	34.6%	8	7	2	4	2	5	13	7	3	6	5	6
FORD	184	63	4.830771	-7.677861	-1.339924	34.2%	8	6	11	8	18	12	7	5	7	3	14	4
FRAM	145	53	6.297398	-7.528794	-1.012629	36.6%	7	5	4	9	14	14	6	2	1	9	9	13
GLEN	257	101	8.390665	-7.677861	-0.600834	39.3%	30	13	15	19	16	8	13	4	5	6	7	5
MALD	185	57	6.933811	-7.677861	-1.594101	30.8%	10	7	7	12	17	4	7	4	5	10	13	1
MARM	197	75	6.764671	-7.528794	-1.013752	38.1%	15	4	13	11	15	17	10	3	7	7	9	4
MIDL	146	42	6.125968	-7.379727	-1.394177	28.8%	9	8	6	9	6	4	8	8	6	9	5	4
OAKW	129	42	6.125968	-7.532308	-1.310802	32.6%	14	5	7	8	5	3	13	5	7	8	4	3
PIED	371	163	8.241598	-7.677861	-0.363095	43.9%	33	38	23	23	19	27	10	11	7	5	4	3
PRAT	290	107	7.389903	-7.677861	-0.829409	36.9%	31	3	7	18	27	21	15	1	4	8	7	5
RAND	98	38	5.529700	-6.033199	-0.855069	38.8%	1	6	5	10	12	4	1	7	5	10	13	4
SHAR	246	60	5.380633	-7.677861	-2.073766	24.4%	15	4	9	12	11	9	13	3	4	8	5	7
SPRI	209	68	6.933811	-7.677861	-1.425657	32.5%	21	4	7	11	18	7	16	2	3	5	11	3
TAFT	171	47	5.599873	-7.677861	-1.418237	27.5%	8	3	6	8	15	7	6	3	6	6	13	6
TISK	130	40	5.529700	-7.528794	-1.544945	30.8%	4	5	9	7	6	9	4	5	9	7	6	9
WALL	173	67	6.317470	-7.528794	-0.793551	38.7%	23	5	4	10	16	9	14	2	1	5	11	7
WATT	123	51	5.678767	-7.677861	-0.839632	41.5%	18	5	5	7	7	9	15	3	4	5	6	7
WEIM	192	65	7.389903	-7.677861	-0.930073	33.9%	14	5	5	12	11	18	9	1	2	8	7	13
TOTs	5097	1776	8.390665	-7.677861	-1.121091	34.8%	424	210	223	306	335	278	271	112	126	185	206	140

10-9-91

Table 4
Probit Formulas for Reading & Math Chapter 1 Eligibility

READING

	Full	Missing Score	Missing L Grade	Missing Score & Grade
Constant	5.62034900	2.32886400	4.09496800	0.42571590
Age	-0.02824640	-0.01661760	-0.02270207	-0.01195141
Test Score	-0.04340120		-0.04776562	
Letter Grade	-0.43142430	-0.52139080		
Retentions	0.73728280	0.54809860	0.77661350	0.67073680

MATH

	Full	Missing Score	Missing L Grade	Missing Score & Grade
Constant	7.06673200	1.63223800	4.49083000	-1.11927900
Test Score	-0.12326810		-0.12395930	
Letter Grade	-0.99706300	-1.03314600		
Grade Level	0.14906700	0.10273220	0.24883260	0.17937590

Reading Recovery
Chapter 1 Status Report

October 1992

This is a brief look at the achievement status of students who received Reading Recovery services during the past two years. Reading Recovery is being piloted for three years by the county in three elementary schools: Glenwood, Piedmont and Tiskelwah. Reading Recovery was first explored at Tiskelwah in the 1989-90 school year with Noel Boling of WV-COGS. The pilot project began the following year. This 1992-93 school year marks the third and final year of the pilot project.

Reading Recovery is an import from New Zealand. The American version is a program

> directed at the bottom 20 percent of first graders: the lowest achieving children in reading and writing, without regard to intelligence, ethnic group, language achievements, school history, physical handicaps, or learning disabilities. It is a one-time intervention that comes at the earliest stage of the child's schooling. Its goal is to accelerate students and help them develop into independent readers, reading with the average in their class, without further help. Reading Recovery requires one-to-one individualized instruction, but only for an average of 12 to 16 weeks. It is a supplemental pull-out program that does not replace the regular classroom reading and writing instruction. (P. C. Dyer. "Reading recovery: A cost-effectiveness and educational-outcomes analysis." *ERS Spectrum*, 10:1, 10-19, Winter 1992.)

Two aspects of Reading Recovery make it attractive for Chapter 1. The program concentrates on reading deficient first graders. Once exited, or through the program successfully, children are to no longer need Chapter 1 services. They are "cured," so to speak. Also these "exited" students are to achieve at a level comparable to their classmates.

With these two aspects in mind, the following analyses of two groups of Reading Recovery students are viewed: last year's (1991-92) and the first year of the pilot (1990-91). They are viewed as to their eligibility for and continuing service by Chapter 1 reading projects. And they are viewed as to their comparability with their classmates on the CTBS reading tests. The data used was routinely collected for Chapter 1 evaluation purposes and not specially collected for Reading Recovery.

Eligibility Status of 1992 Reading Recovery Students. Table 1 displays the current eligibility status of the 37 students who received Reading Recovery at the three schools and the 20 who were reported as exiting. One school served first graders who did not

meet eligibility requirements of the Chapter 1 first grade project. These six students were removed to make the results more comparable with the Chapter 1 first grade reading program.

The Chapter 1 reading program was conducted last year at 26 schools, but is represented in this report by projects at 13 schools. These 13 schools reported spending more time with first grade Chapter 1 students than average. Thus I designated them as having an emphasis on first grade. The schools were Alum Creek, Anne Bailey, Bridge, Cedar Grove, Chesapeake, Edison, Frame, Midland Trail, Oakwood, Pratt, Sharon Dawes, Wallace Heights, and Weimer. Since Reading Recovery is a program for first graders, these schools would have comparable results because of their emphasis.

I want to point out two things about this table. Of the 14 Chapter 1 eligible students exiting Reading Recovery who were not placed in Special Education, 3 (23.1 percent) are currently eligible for Chapter 1 reading this year. Reading Recovery students of 1990-91 were and are eligible and served as will be shown in Table 3. Second, Of the 31 Chapter 1 eligible students served in Reading Recovery, 16 are eligible this year, or 61.5 percent. The percent is only slightly less than the 67.3 percent of students who were served in regular Chapter 1.

Achievement Status of 1992 Reading Recovery Students. Table 2 displays the achievement of the Reading Recovery students sandwiched between the achievement of their classmate peers and of students in the regular Chapter 1 first grade reading program at the 13 schools.

Classmates of Reading Recovery students are those first grade students at Glenwood, Piedmont and Tiskelwah who were not eligible for Chapter 1. Non-eligible students with reading Z-index numbers were divided into four groups. The Z-index number is a standard score designed to measure deficiency. Zero (0) divides the area under the normal curve in half. Positive Z-index numbers designate students deficient in reading and eligible for Chapter 1; negative scores indicate the opposite of deficiency of students and not eligible. I divided the negative half of the normal curve into four areas, labeled Q1, Q2. Q3, Q4 on the table. Q1 are students with the highest achievement, Q2 students have the second highest achievement, Q3 have the third highest achievement and so on.

Table 2 compares ten groups of first graders, then. The four groups of "classmates"; Reading Recovery students served and exited; Reading Recovery students served and exited, minus the five high scorers on the MRT (Metropolitan Readiness Test) who are incompatible with the first graders served in Chapter 1; and the first graders served in Chapter 1 reading and those who exited.

These groups are compared on five test scores: the pre-reading composite score on the MRT, given in May, 1991: and the word attack, vocabulary, comprehension and total reading scores on the CTBS/4 (Comprehensive Test of Basic Skills, 4th edition), given in March, 1992. National percentile scores of the students were transformed into NCEs to allow for the comparisons.

Please notice two things about the non-deficient classmates. Their MRT means follow their Z-index categories. The higher the quartile (1 being high), the higher the mean. The means of the other test scores follow the same pattern generally. Q1 has the highest word attack, vocabulary and total reading mean scores, and Q4 the lowest. The exception is the comprehension means for Q1 and Q2. There is no significant difference between them. Nevertheless, the correlation between quartile ranks and test means illustrates the common psychometric finding that-- all things being equal-- largest component of a test score is a previous score. This is certainly evident here.

The purpose of intervention programs such as Reading Recovery and Chapter 1 is break this "rule." We would assume Reading Recovery and Chapter 1 should get children to an achievement level similar to quartiles 3 and 4. This occurs for the exited students. It is interesting to observe that the mean scores of the exited Chapter 1 students are virtually indistinguishable from Q3 and Q4, whereas the exited students of the comparable Chapter 1 Reading Recovery are not as high.

Eligibility Status of 1991 Reading Recovery Students. Table 3 displays the current eligibility status of the 25 students who received Reading Recovery during the 1990-91 school year and the 15 who were reported as exiting. We see that of the 15 exiting, over half were eligible for Chapter 1 reading in the second grade and 6 were served. Currently 3 of the 15 are eligible.

Achievement Status of 1991 Reading Recovery Students. Table 4 displays the achievement of the Reading Recovery students and their 1991-92 classmates. There is a general lessening of the effect of MRT scores on second grade results. However the quartile pattern of Table 2 is still evident. The classmates are scoring higher in the second grade than their first grade counterparts. However the mean test scores of the exited Reading Recovery students are no longer similar to the lower quartiles.

Instructional Attendance of 1992 Reading Recovery Students. Table 5 displays the average number of days attended in Reading Recovery and Chapter 1 by eligible students in 1991-92. Chapter 1 teachers were asked to turn in the number of days they saw their students as part of their end-of-the-year desired outcome report. Teachers spent an average of 112 days in serving Reading Recovery children.

Children who exited had an average of 108 days. By contrast Chapter 1 students received an average of 141 days whether they exited or not. Using a five-day week, we see that Reading Recovery served (RR/S) children received an average of 22.5 weeks of instruction; Reading Recovery exited (RR/E), 21.7 weeks; and Chapter 1 served and exited (Ch1/S, Ch1/E), 28.2 weeks.

Summary

It is evident that Reading Recovery does work in bringing students up to the achievement levels of their classmates during the year of receiving instruction. The regular Chapter 1 program seems to do the same. The exited Reading Recovery students may need follow-up, however, to maintain their progress.

The hope that the "cured" students would not need additional service does not seem to be evident. Approximately one-fifth of these students are currently eligible for Chapter 1 reading. The year following instruction, achievement levels of Reading Recovery students are no longer equivalent to their classmates.

The program in the County does not seem to follow the description usually given. We found that children were being served who were well above the "bottom 20 percent." We also found that children stayed in the program longer than "an average of 12 to 16 weeks." Students who exited the program in 1992 averaged 108 days in attendance according to their Reading Recovery teachers. This figures to be about 21 weeks.

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Kanawha County Schools

TABLE 1

Number and Percent of Students in
1991-92 Reading Recovery and Regular Chapter 1
First Grade Programs
Eligible for Chapter 1 Services in 1992-93

	RR/S	RR/E	Ch 1 RR/S*	Ch 1 RR/E*	Ch1/S	Ch1/E
N	37	20	31	14	247	74
Missing	5	2	4	1	14	0
Sp Ed	1	0	1	0	7	0
Eligible	16	3	16	3	152	0
Percent	51.6%	16.7%	61.5%	23.1%	67.3%	0.0%

Legend

RR/S	Reading Recovery students served
RR/E	Reading Recovery students who exited
Ch 1 RR/S	Chapter 1 eligible Reading Recovery students served
Ch 1 RR/E	Chapter 1 eligible Reading Recovery students who exited
Ch1/S	Chapter 1 students served at 13 schools emphasizing first grade
Ch1/E	Chapter 1 students served at the 13 schools whose 1993 reading index was less than 0 (zero), i.e., they did not qualify for continued services

* Less six students who were not eligible for Chapter 1 reading services during the 1991-92 school year.

15 Oct 92

TABLE 2

NCE Means & Standard Deviations for Students in 1991-92 Reading Recovery, Classmates and Regular Chapter 1 First Grade Programs

		Q 1	Q 2	Q 3	Q 4	RR/S	RR/E	Comp RR/S*	Comp RR/E*	Ch1/S	Ch1/E
MRT	X	91.1	82.9	69.6	65.6	41.8	51.1	33.5	37.0	34.9	44.4
Readin	SD	6.0	1.8	6.9	5.1	23.8	24.7	16.5	15.5	13.2	10.6
	N	3	6	5	11	29	20	24	11	156	43
CTBS/4	X	67.5	56.9	62.6	41.6	36.1	41.5	33.7	38.1	41.0	52.0
Word S	SD	10.7	13.4	23.7	13.3	14.4	14.4	13.5	14.3	16.9	14.1
	N	4	8	7	12	33	18	29	14	163	50
CTBS/4	X	70.1	62.7	56.6	54.5	44.0	54.6	41.5	52.4	40.9	56.7
Vocab	SD	5.2	26.0	29.7	19.4	19.7	17.3	18.9	17.2	17.1	13.1
	N	4	8	7	12	34	19	30	15	235	64
CTBS/4	X	67.1	67.8	58.9	52.9	43.5	53.8	40.9	51.4	41.2	56.7
Compre	SD	18.2	20.7	14.3	21.7	18.5	12.9	18.2	13.4	17.8	13.5
	N	4	8	7	12	33	18	29	14	235	64
CTBS/4	X	68.4	66.9	58.6	53.4	42.9	54.5	40.1	52.0	40.5	57.0
Total	SD	11.6	23.9	22.8	20.8	19.0	14.1	18.4	14.4	16.9	12.0
Readin	N	4	8	7	12	33	18	29	14	235	64

Legend

Q1	First grade students at Glenwood, Piedmont and Tiskelwah who were not eligible for Chapter 1 and had reading Z-indices -1.149001 or less, i.e., the "top" students
Q2	Non eligible classmates with reading indices between -0.674001 and -1.149000
Q3	Non eligible classmates with reading indices between -0.319001 and -0.674000
Q4	Non eligible classmates with reading indices between 0.0 and -0.319000
RR/S	Reading Recovery students served
RR/E	Reading Recovery students who exited
Comp RR/S	Reading Recovery students served comparable to Chapter 1
Comp RR/E	Reading Recovery students who exited comparable to Chapter 1
Ch1/S	Chapter 1 students served at 13 schools emphasizing first grade
Ch1/E	Chapter 1 students served at the 13 schools whose 1993 reading index was less than 0 (zero), i.e., they did not qualify for continued services

* Less five students who had percentile scores above 85 unlike any regular Chapter 1 first grade student served. The scores omitted were: 87, 93, 93, 95 97. (All were served at Tiskelwah.)

15 Oct 92

TABLE 3

Number and Percent of Students in
1990-91 Reading Recovery
Eligible for and Served in Chapter 1 1991-93

	1991-92 Eligible		1991-92 Served		1992-93 Eligible	
	RR/S	RR/E	RR/S	RR/E	RR/S	RR/E
N	25	15	25	15	25	15
Missing	1	1	0	0	1	0
Sp Ed	2	0	1	0	2	1
Eligible	16	8	12	6	7	3
Percent	72.7%	57.1%	50.0%	40.0%	31.8%	21.4%

15 Oct 92

TABLE 4

NCE Means & Standard Deviations for Students in 1990-91 Reading Recovery and Second Grade Classmates 1991-92

		Q 1	Q 2	Q 3	Q 4	RR/S	RR/E
MRT	X	79.8	62.3	59.8	50.8	39.1	39.0
Readin	SD	11.3	7.3	23.4	19.5	16.8	17.3
	N	13	9	14	22	19	10
CTBS/4	X	77.0	55.8	56.3	58.3	23.0	31.6
Word S	SD	18.6	13.6	19.1	23.1	11.9	15.6
	N	5	8	8	14	8	3
CTBS/4	X	77.6	76.5	63.9	57.0	41.9	47.8
Vocab	SD	16.1	16.2	15.9	18.1	16.0	11.5
	N	11	11	12	28	22	13
CTBS/4	X	75.0	71.4	67.3	59.8	43.3	52.0
Compre	SD	15.7	10.6	16.1	16.3	15.8	10.8
	N	11	11	12	28	22	13
CTBS/4	X	77.8	74.9	66.6	58.9	43.1	49.3
Total	SD	16.5	13.8	15.9	16.1	14.7	10.0
Readin	N	11	11	12	28	22	13

15 Oct 92

TABLE 5

Average Number of Days Receiving Instruction by Students in Reading Recovery & Regular Chapter 1 Programs 1991-92

	RR/S	RR/E	Ch1/S	Ch1/E
Average	112.3	108.3	141.2	141.2
N	28	13	241	69

Addendum

Chapter 1 Eligibility Factors & Weights:
Using Probit Analysis to Determine Eligibility Criteria

The weights given for the math "formula" on Page 5 are not the original weights. These weights were derived from the data set modified by the math supervisor and Chapter 1 math teachers at the six schools. They identified the 1988-89 first and second graders who were served in the 1990-91 program. They gave all first and second grade students test scores and letter grades. Using the original model on this data set gave the weights given on Page 5. These weights had huge t-statistics, a Chi-square of 688.685, an N of 878 which gave a pseudo-R of 0.439.

1993 FALL ELIGIBILITY STATISTICS: READING

SCH	N	M	% R	1st	2nd	3rd	4th	5th	6th
ALUM	205	45	22.0%	15	9	9	4	5	3
ANNE	341	94	27.6%	37	21	13	14	6	3
BONH	301	70	23.3%	29	21	8	8	4	X
BRID	154	42	27.3%	16	6	9	3	8	X
CEDA	397	113	28.5%	43	25	17	10	12	6
CHAN	177	43	24.3%	21	9	6	2	3	2
CHES	204	50	24.5%	12	9	7	12	3	7
EDIS	190	24	12.6%	9	7	3	0	2	3
FORD	198	57	28.8%	17	8	10	5	8	9
GLEN	303	86	28.4%	20	24	13	13	12	4
MALD	213	54	25.4%	18	14	13	3	1	5
MARM	243	72	29.6%	26	14	10	12	5	5
MIDLA	150	37	24.7%	13	15	6	2	1	0
OAKW	144	26	18.1%	14	4	4	0	3	1
PIED	435	94	21.6%	36	29	17	6	4	2
PRAT	316	60	19.0%	30	10	6	5	6	3
RAND	169	27	16.0%	8	4	6	6	1	2
SHAR	260	55	21.2%	18	17	9	5	5	1
TAFT	198	51	25.8%	12	11	9	8	9	2
TISK	179	18	10.1%	13	1	1	1	1	1
WATT	170	42	24.7%	11	9	11	4	5	2
WEIM	203	47	23.2%	22	8	11	6	0	0
TOTs	5150	1207	23.4%	440	275	198	129	104	61
				36.5%	22.8%	16.4%	10.7%	8.6%	5.1%

09-28-92

1993 FALL ELIGIBILITY STATISTICS: MATH

SCH	N	M	% M	1st	2nd	3rd	4th	5th	6th
ALUM	205	51	24.9%	7	3	13	7	12	9
ANNE	341	76	22.3%	11	14	6	17	14	14
BONH	301	56	18.6%	14	12	8	11	11	X
BRID	154	30	19.5%	9	4	3	5	9	X
CEDA	397	101	25.4%	20	17	15	16	13	20
CHAN	177	43	24.3%	2	17	6	2	6	10
CHES	204	66	32.4%	11	9	9	9	14	14
EDIS	190	29	15.3%	5	5	2	2	6	9
FORD	198	65	32.8%	5	5	9	9	21	16
GLEN	303	84	27.7%	9	16	6	17	22	14
MALD	213	59	27.7%	7	6	16	8	7	15
MARM	243	60	24.7%	16	0	8	10	15	11
MIDLA	150	38	25.3%	8	7	8	7	3	5
OAKW	144	27	18.8%	5	2	3	8	4	5
PIED	435	121	27.8%	12	24	20	20	25	20
PRAT	316	74	23.4%	15	7	2	13	20	17
RAND	169	29	17.2%	2	2	9	5	3	8
SHAR	260	42	16.2%	2	1	6	5	20	8
TAFT	198	61	30.8%	4	8	7	12	17	13
TISK	179	20	11.2%	3	5	3	1	4	4
WATT	170	43	25.3%	7	6	8	5	9	8
WEIM	203	51	25.1%	7	3	9	12	10	10
TOTs	5150	1226	23.8%	181	173	176	201	265	230
				14.8%	14.1%	14.4%	16.4%	21.6%	18.8%

09-28-92